# Dissipation of Dislodgeable Foliar Residues of Propargite Grape Foliage

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## SUMMARY

Propargite has received considerable recent attention as a cause of dermatitis in agriculture. Subsequently, studies have been conducted to evaluate the dissipation of the pesticide. Grape foliage in Napa and Madera Counties was sampled during July and August, 1989. In this limited effort, geographic location, initial deposition, and ambient temperature did not have a significant effect on the dissipation rate. Half-lives were variable, falling within a range of 3.6 to 9.7 days. However, the variability of the data make the results difficult to interpret.

## INTRODUCTION

Propargite (2-[4-(1,1-dimethylethyl)phenoxy]cyclohexyl-2-propynyl sulfite) is an acaricide for use in tree and row crops such as stone fruit, grapes, cotton and nut crops. The compound is formulated as an emulsifiable concentrate and a wettable powder. From a toxicological standpoint, propargite has a reported oral $LD_{50}$ of 1480 mg/kg in both male and female rats, and a dermal $LD_{50}$ of 250 and 680 mg/kg in male and female rats, respectively (Gaines, 1969). The dermal $LD_{50}$ for rabbits is considerably higher approaching 10,000 mg/kg (Wiswesser, 1976). Propargite has been shown to cause maternal toxicity in rabbits (Thongsinthusak et al., 1990).

Propargite has been associated with numerous dermatitis cases, most notably in recent years, an incident involving three nectarine harvest crews in June 1988. Forty-two field workers were found to have symptoms positively correlated with a recent application of propargite. A no observable effect level (NOEL) for exposure to propargite during stone fruit harvest was determined to be 0.2 ug/cm² (O'Malley et al., 1988). A NOEL for work in grapes has not been determined.

The importance of establishing a viable reentry interval for specific crops cannot be overemphasized. The original reentry interval of seven days for grapes was established in 1971, and later amended to 30 days as more comprehensive data became available. The primary goal of our study was to add information on the dissipation of propargite to the data base with the eventual goal of establishing a grape/work task specific reentry interval.

## MATERIALS AND METHODS

Applications:

Eight vineyards, located in Napa (2) and Madera (6) Counties, were treated with Omite 30W (EPA registration no. - 400-82 AA) between July 20 and July 27, 1989. Application rates, shown in Table 1, ranged from 0.9 to 1.5 lb active ingredient (ai) per acre.

Sampling Methods:

A five row buffer was established on all sides of the experimental plot to reduce the possibility of an edge effect affecting the results. Six (later amended to four) sampling rows were randomly selected from each vineyard. The sampling scheme for this particular study approximated a diagonal pattern across the designated fields. For sampling row A, the first sample was collected from vine 5, for row B, the first sample was collected from vine 10 and so forth through row F.

Forty vines in each sampling row were selected and marked for leaf disc sampling. One leaf disc was collected from each vine, using a Birkestrand® leaf punch (leaf disc surface area of 5 cm²). The leaves were randomly selected within close proximity to the ripening fruit to better approximate the potential exposure of field workers. The same rows and vines were sampled during subsequent sampling intervals.

Cultural activities such as cane turning, cane cutting, and harvesting are subject to the demands of a particular grape variety. As a result, it was difficult to determine which side of the vineyard would eventually be harvested by the field worker. In order to provide an adequate representation of the overall dissipation profile, sampling was conducted on north and south facing rows, randomly assigned.

Sample Analysis:

Once collected, samples are sealed, placed on ice and transported to the CDFA chemistry laboratory in Sacramento. All leaf discs were extracted within 24 hour of collection.

Propargite residue was washed from the leaf discs by rotating them in a surfactant solution. Propargite was then extracted from the solution with methylene chloride, and dried. The sample was then analyzed on a Varian 6000 FPD in the sulfur mode.

Data Analysis:

The laboratory reported values of propargite for each sample were divided by the surface area of 400 $cm^2$ (40 two-sided leaf discs). Sample results were transformed using the common log. The results were analyzed using a first order log-linear decay model. Half-lives were determined using the following formula: $t_{1/2}=\log_{10}(1/2)/\text{slope}_{10}$.

The fields were monitored until all of the replicates of the sample were below the minimum detection level (MDL, 0.01 ug/$cm^2$). Only actual data were used in the regression analysis (MDLs or estimates thereof were not considered).

## RESULTS

The location, grape variety, time of application, rate of application, irrigation method, initial deposition and half-life for each of the fields monitored are listed in Table 1. The dissipation curves for each county (sites combined) are shown in Figure 1. The average temperature for the Madera and Napa County study sites was 83$^{o}$F and 72$^{o}$F, respectively.

The half-life values were quite variable and were generally lower for the vineyards in Madera County (3.6 - 6.0 days) as compared to Napa County (7.5 - 9.7 days). However, the difference was not significant ($p>0.05$), probably a result of the variation in the data (low correlation coefficients) and the small data sets. The average temperature for the two areas is markedly different ($p<0.01$). However, in this study it does not appear to have an effect on the dissipation of propargite.

## DISCUSSION AND CONCLUSIONS

The results of this investigation are generally in agreement with the previous findings of propargite on grape foliage (Maddy et al., 1986). Dissipation of propargite appears to be quite variable. Maddy et al. (1986) had correlation coefficients ($R^2$) of less than 0.2 for the two applications monitored in that study. As noted in Table 1, R-squared values for this investigation ranged from 0.73 to 0.83 for the Madera County vineyards and from 0.48 to 0.63 for the Napa County vineyards studied.

No significant difference was noted in the DFR half-life between the two study sites. The Napa sites had both higher application rates and lower temperatures. Further study into this area is essential to understanding the behavior of this and other pesticides.

## ACKNOWLEDGMENTS

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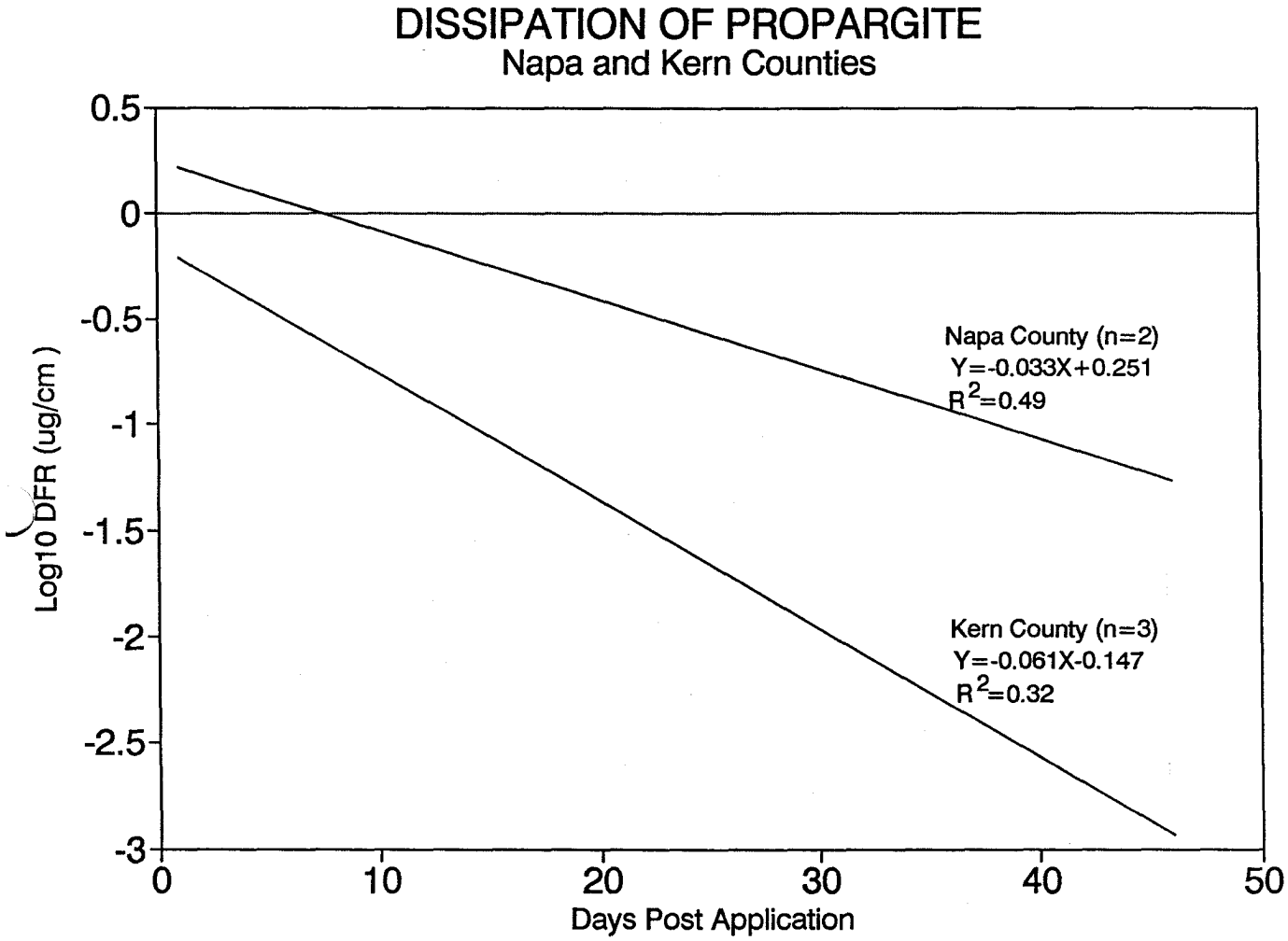
TABLE 1:

# 1989 PROPARGITE DFR RESULTS

| Location/ Variety | Sampling Interval | Sample Results (µg/cm²) A | B | C | D | E | F | Mean | Half-life (days) | Estimated Initial Deposition | R-squared | Application Rate (lb./acre) | Application Date | Type of Irrigation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Kern/** | 0.5 | 0.179 | 0.804 | 0.536 | 0.179 | 0.357 | 1.072 | 0.676 | 3.72 | 0.796 | 0.32 | 3.0 | July 26 | Flood |
| Thompson | 1.0 | 1.106 | 1.495 | 0.615 | 1.153 | 1.641 | 1.324 | 1.400 | | | | | | |
| Field 1 | 2.0 | 2.174 | 1.498 | 1.504 | 1.177 | 1.769 | NS | 1.193 | | | | | | |
| | 7.0 | 0.017 | 0.039 | 0.100 | 0.150 | 0.011 | 0.105 | 0.083 | | | | | | |
| | 12.0 | 0.170 | 0.498 | 0.189 | 0.203 | 0.188 | 0.000 | 0.197 | | | | | | |
| | 20.0 | ND | ND | ND | ND | ND | ND | ND | | | | | | |
| | 36.0 | ND | ND | ND | ND | ND | ND | ND | | | | | | |
| Kern/ | 0.5 | 1.791 | 1.778 | 1.941 | 1.563 | 2.399 | 1.779 | 1.875 | 3.64 | 0.777 | 0.34 | 3.0 | July 26 | Flood |
| Thompson | 1.0 | 1.042 | 0.883 | 1.066 | 0.854 | 0.566 | 0.894 | 0.884 | | | | | | |
| Field 2 | 7.0 | 0.014 | 0.034 | 0.024 | 0.013 | 0.024 | 0.013 | 0.020 | | | | | | |
| | 12.0 | 0.121 | 0.563 | 0.202 | 0.261 | 0.149 | 0.057 | 0.226 | | | | | | |
| | 20.0 | ND | ND | 0.113 | ND | NS | NS | 0.113 | | | | | | |
| | 28.0 | ND | ND | ND | ND | NS | NS | ND | | | | | | |
| | 36.0 | ND | ND | ND | ND | NS | NS | ND | | | | | | |
| Kern/ | 1.0 | 2.330 | 0.920 | 0.866 | 2.156 | 1.136 | NS | 1.482 | 6.07 | 1.255 | 0.84 | 4.0 | July 27 | Drip |
| Thompson | 15.0 | 0.142 | 0.156 | 0.098 | 0.233 | NS | NS | 0.157 | | | | | | |
| Field 3 | 34.0 | ND | ND | ND | 0.052 | NS | NS | 0.052 | | | | | | |
| | 41.0 | ND | ND | ND | ND | NS | NS | 0.000 | | | | | | |
| Napa/ | 3.0 | 5.380 | 4.050 | 3.930 | 4.110 | NS | NS | 4.368 | 7.47 | 1.635 | 0.48 | 5.0 | July 20 | Drip |
| Zinfindel | 5.0 | 0.892 | 0.586 | 0.942 | 0.652 | NS | NS | 0.768 | | | | | | |
| | 10.0 | 0.672 | 0.148 | 0.170 | 0.174 | NS | NS | 0.291 | | | | | | |
| | 16.0 | 0.548 | 0.148 | 0.235 | 0.234 | NS | NS | 0.291 | | | | | | |
| | 24.0 | 0.122 | ND | ND | ND | NS | NS | 0.122 | | | | | | |
| | 30.0 | 0.368 | 0.150 | ND | 0.150 | NS | NS | 0.229 | | | | | | |
| | 46.0 | ND | ND | ND | ND | NS | NS | ND | | | | | | |
| Napa/ | 3.0 | 5.380 | 2.730 | 7.740 | 4.510 | NS | NS | 4.413 | 9.66 | 2.170 | 0.63 | 5.0 | July 20 | Drip |
| Cabernet | 5.0 | 0.892 | 1.060 | 1.020 | 1.480 | NS | NS | 1.413 | | | | | | |
| | 10.0 | 0.672 | 0.879 | 0.424 | 0.769 | NS | NS | 0.846 | | | | | | |
| | 16.0 | 0.548 | 0.362 | 0.324 | 0.354 | NS | NS | 0.437 | | | | | | |
| | 24.0 | 0.122 | ND | 0.169 | ND | NS | NS | 0.176 | | | | | | |
| | 30.0 | 0.368 | 0.276 | 0.276 | 0.238 | NS | NS | 0.352 | | | | | | |
| | 46.0 | ND | ND | 0.211 | ND | NS | NS | 0.211 | | | | | | |

FIGURE 1:


DISSIPATION OF PROPARGITE
Napa and Kern Counties
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
Log10 DFR (ug/cm )
0
10
20
30
40
50
Days Post Application
Napa County (n=2)
Y=-0.033X+0.251
R2=0.49
Kern County (n=3)
Y=-0.061X-0.147
R2=0.32